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EXAMINER

MISLEH, JUSTIN P

ART UNIT	PAPER NUMBER
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2612

DATE MAILED: 12/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/768,454

Applicant(s)

FUKUYOSHI ET AL.

Examiner

Justin P Misleh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 20 August 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1 - 17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3 - 6, and 12 - 17 is/are rejected.
- 7) ☒ Claim(s) 2 and 7 -- 11 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                    | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Arguments*

1. Applicant's arguments, filed 20 August 2004, with respect to the rejection of Claims 1 and 12 and under 35 U.S.C. 103(a) as being unpatentable over Isokawa (JP 05-145813 A) in view of Naka et al. (US Patent No 5,239,412) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of Nakai et al. (JP 04-257459 A).

2. Applicant's arguments, filed 20 August 2004, with respect to the rejection of Claim 7 under 35 U.S.C. 103(a) as being unpatentable over Isokawa (JP 05-145813 A) in view of Naka et al. (US Patent No 5,239,412) have been fully considered and are persuasive. The rejection of Claims 7 – 11 has been withdrawn.

3. Additionally, Applicant's amendments to the specification and claims overcome the respective previous objections; however, the amendment to the <sup>title</sup>~~file~~ does not overcome the objection to the title (see objection below). The Examiner accepts the drawings, filed 25 January 2001.

### *Specification*

4. The amended title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The Examiner recommends the following title: A Micro Lens Array Including an Etched Ditch and Transparent Resin Layer and Method of Manufacturing the Same.

***Claim Objections***

5. **Claims 2, 3, 6, 7, 14, 15, and 16** are objected to because of the following informalities: minor typographical errors.

- For **Claim 2**, the claims states therein, “the minimum thickness” and “the arranging direction” when “the minimum thickness” and “the arranging direction” has not been previously introduced.

- For **Claims 3 and 6**, the claims states therein, “the gap” and “the arranging direction” when “the gap” and “the arranging direction” has not been previously introduced.

- For **Claim 14**, the claims states therein, “the arranging direction” when “the arranging direction” has not been previously introduced.

- For **Claims 15 and 16**, the claims states therein, “the surface” when “the surface” has not been previously introduced.

- For **Claim 7**, the claim language therein presents numerous errors to the extent described above. For the sake of brevity, the Examiner will not detail each instance; however, an example includes “the surface” when “a surface” has not been previously introduced.

For all the above and remaining claims, the Applicant is asked to thoroughly review the claim language to identify and correct all the typographical errors including the same as those cited above and similar errors.

**Appropriate correction is required.**

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 1, 3 – 6, and 12 – 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Isokawa (JP 05-145813 A) in view of Nakai et al. (JP 04-257459 A).

The Isokawa reference is a published Japanese Patent Application (11 June 1993). An English language Abstract as well as an English language computer translation of Isokawa have been provided by the Examiner and will be used as a basis for the following rejections.

Furthermore, the Nakai et al. reference is also a published Japanese Patent Application (1 October 1992). An English language Abstract of Nakai et al. has been provided by the Examiner and will be used as a basis for the following rejections.

8. For **Claim 1**, Isokawa discloses, as shown in figure 3 and as stated in paragraphs 0014 – 0016, a solid state image-pickup device, comprising:

a lens array (7; at least a single row array of lenses) formed by arranging a plurality of resin (“transparent resin,” see paragraph 0009) lenses in a manner to form a matrix (Adjacent lenses 7 in figure 3 at least form a one row/column by two row/column array.);

an undercoat layer (flat layer 2; a “transparence resin layer pattern is formed on a light sensing portion,” see paragraph 0009) for fixing said lens array (7) and having a ditch (6) formed between said adjacent resin lenses (Figure 3 clearly shows a “ditch” formed in the flat layer 2 between adjacent lenses 7.); and

wherein a micro lens array (Adjacent lenses 7 in figure 3 at least form a one row/column by two row/column array) is formed which comprises a plurality of micro lenses (7) arranged in a matrix (Adjacent lenses 7 in figure 3 at least form a one row/column by two row/column array), wherein the micro lenses include the resin lenses (7; see paragraph 009).

While Isokawa discloses a solid state image-pickup device comprising a micro lens matrix (see figure 3) including a plurality of lenses (7) formed adjacent to one another on an undercoat layer (2) wherein between adjacent lenses (7) a ditch (6) is formed in the undercoat layer (2); Isokawa does not disclose wherein a transparent layer covers the solid-state image-pickup device including covering said plural resin lenses with substantially the same thickness and the ditch between said adjacent resin lenses.

On the other hand, Nakai et al. also provides a solid state image-pickup device including a micro lens matrix formed by a plurality of micro lenses. More specifically, Nakai et al. disclose, as shown in figure 1 and as stated in the abstract, a micro lens matrix comprised of a plurality of micro lenses (1). Furthermore, Nakai et al. teach, that a transparent resin layer (6; "epoxy resin, acrylic resin, polyester resin," etc.) covers the solid state image-pickup device including covering the plurality of micro lenses (1) with substantially the same thickness ("given thickness over a micro lens surface uniformly") and the gap between the adjacent micro lenses (clearly shown figure 1).

As stated in the abstract, at the time the invention made, one with ordinary skill in the art would have been motivated to include a transparent layer that covers the plurality of micro lenses with substantially the same thickness and covering the gap between the adjacent micro lenses, as clearly taught by Nakai et al., in the solid state image-pickup device including micro lenses and a

ditch between adjacent micro lenses, as disclosed by Isokawa, as a means to provide an antireflective coating so as to increase the light absorption efficiency of the solid state image-pickup device. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to provide a transparent layer that covers the plural resin lenses with substantially the same thickness and also covers the ditch between said adjacent resin lenses.

9. As for **Claim 3** (please see objection above), the aim of Applicant's invention is to increase the light absorption efficiency of the micro lens array. It is also the aim of Isokawa and Nakai et al. to respectively achieve the same. To achieve the same, Isokawa tries to minimize a gap between adjacent lenses by etching a ditch into an undercoat layer between the adjacent lenses and Nakai et al. simply forms a transparent resin layer of uniform thickness on the lenses and in the gaps between the lenses so as provide an antireflective coating. Isokawa does not specify that the gap falls within a range between 0.0005 micrometer and 0.3 micrometer; however, since the effect of Nakai et al. is the same as Applicant's, the Examiner believes choosing a range of thickness for the transparent resin layer, as required by the claim language, is an obvious matter of design choice.

10. As for **Claim 4**, the aim of Isokawa is to eliminate the 1 micrometer gap between adjacent micro lenses (7). To eliminate the gap, Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3.

By visualizing a 30-60-90 triangle that includes a base side extending from the bottom edge of a micro lens along the surface of the flat layer for half distance of the gap (0.5 micrometer) and a height side representing the ditch depth starting at the surface of the flat layer.

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The law of sines tells us that the ditch depth must be at least 0.8 micrometers deep. Therefore, Isokawa satisfies the ditch depth requirement range of 0.05 micrometers and 1.5 micrometers.

The aim of Applicant's invention is to increase the light absorption efficiency of the micro lens array. It is also the aim of Isokawa and Nakai et al. to respectively achieve the same. To achieve the same, Isokawa tries to minimize a gap between adjacent lenses by etching a ditch into an undercoat layer between the adjacent lenses and Nakai et al. simply forms a transparent resin layer of uniform thickness on the lenses and in the gaps between the lenses so as provide an antireflective coating. Nakai et al. does not specify the uniform thickness of the transparent resin layer; however, since the effect of Nakai et al. is the same as Applicant's, the Examiner believes choosing a range of thickness for the transparent resin layer, as required by the claim language, is an obvious matter of design choice.

11. As for **Claim 5**, the Applicant states in the specification on page 22, "Also it is desirable to select a resin of the undercoat layer 17 having an etching rate higher than (for example, about three times) that of the base material of the resin lens 21b for forming the undercoat layer 17. This selection is in order to retain the shape of the resin lens 21b."

The aim of Isokawa is also to offer "the manufacture approach of the micro lens for solid state image pickup devices which the gap between lenses was vanished and made the rate of condensing high more." To make "the rate of condensing high more", it is imperative that the resin lenses (3) retain their shape. Similarly, Isokawa discloses a resin undercoat layer (2) and resin lenses (3).

Isokawa is silent with respect to the rate of the etching; however, since Isokawa accomplishes the same aim as the Applicant by not specifying an etching rate, the Examiner



believes that the Applicant's choice of etching rate is merely an obvious matter of design preference.

12. As for **Claim 6** (please see objection above), Isokawa clearly disclose, as shown in figure 3, that there is no gap between adjacent micro lenses (7). Therefore, Isokawa disclose wherein the gap between adjacent resin lenses in the arranging direction of said lens array is not larger than 0.6 micrometers.

13. For **Claim 12**, Isokawa discloses, as shown in figure 3 and as stated in paragraphs 0014 – 0016, a method of manufacturing a solid-state image pickup device (1), comprising:

forming a photosensitive resin layer (7) on an undercoat layer (flat layer 2);  
exposing said photosensitive resin layer (7) to light in a predetermined pattern (photolithography), followed by a developing treatment so as to form a resin pattern layer (7) having a predetermined gap width (gaps 6 have a 1.0 micrometer gap width); and  
subjecting said resin pattern layer (7) to a heat flow so as to form a resin lens array which is arranged a plurality of resin (see paragraph 0009) lenses (Adjacent lenses 7 in figure 3 at least form a one row/column by two row/column array.);

applying an etching treatment to those portions of said undercoat layer (2) which are exposed in regions between adjacent resin lenses to form ditches (6; see paragraph 0014).

While Isokawa discloses exposing, subjecting, and applying to form a solid state image-pickup device comprising a micro lens matrix (see figure 3) including a plurality of lenses (7) formed adjacent to one another on an undercoat layer (2) wherein between adjacent lenses (7) a ditch (6) is formed in the undercoat layer (2); Isokawa does not disclose forming a transparent resin layer on the surfaces of said resin lenses and said undercoat layer.

On the other hand, Nakai et al. also provides a solid state image-pickup device including a micro lens matrix formed by a plurality of micro lenses. More specifically, Nakai et al. disclose, as shown in figure 1 and as stated in the abstract, a micro lens matrix comprised of a plurality of micro lenses (1). Furthermore, Nakai et al. teach, that the formation of a transparent resin layer (6; "epoxy resin, acrylic resin, polyester resin," etc.) covering the solid state image-pickup device including covering the plurality of micro lenses (1) with substantially the same thickness ("given thickness over a micro lens surface uniformly") and the gap, including an undercoat layer, between the adjacent micro lenses (clearly shown figure 1).

As stated in the abstract, at the time the invention made, one with ordinary skill in the art would have been motivated to include form a transparent layer that covers the plurality of micro lenses with substantially the same thickness and covers the gap between the adjacent micro lenses, as clearly taught by Nakai et al., in the solid state image-pickup device including micro lenses and a ditch between adjacent micro lenses, as disclosed by Isokawa, as a means to provide an antireflective coating so as to increase the light absorption efficiency of the solid state image-pickup device. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to provide forming a transparent resin layer on the surfaces of said resin lenses and said undercoat layer.

14. As for **Claim 13**, the aim of Isokawa is to eliminate the 1 micrometer gap between adjacent micro lenses (7). To eliminate the gap, Isokawa etches ditches in the undercoat layer (flat layer 2), as shown in figure 3.

By visualizing a 30-60-90 triangle that includes a base side extending from the bottom edge of a micro lens along the surface of the flat layer for half distance of the gap (0.5

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micrometer) and a height side representing the ditch depth starting at the surface of the flat layer. The law of sines tells us that the ditch depth must be at least 0.8 micrometers deep. Therefore, Isokawa satisfies the ditch depth requirement range of 0.05 micrometers and 1.5 micrometers.

15. As for **Claim 14** (please see objection above), Isokawa clearly disclose, as shown in figure 3, that there is no gap between adjacent micro lenses (7). Therefore, Isokawa disclose wherein the gap between adjacent resin lenses in the arranging direction of said lens array is not larger than 0.6 micrometers.

16. As for **Claim 15** (please see objection above), the aim of Applicant's invention is to increase the light absorption efficiency of the micro lens array. It is also the aim of Isokawa and Nakai et al. to respectively achieve the same. To achieve the same, Isokawa tries to minimize a gap between adjacent lenses by etching a ditch into an undercoat layer between the adjacent lenses and Nakai et al. simply forms a transparent resin layer of uniform thickness on the lenses and in the gaps between the lenses so as provide an antireflective coating. Nakai et al. does not specify the uniform thickness of the transparent resin layer; however, since the effect of Nakai et al. is the same as Applicant's, the Examiner believes choosing a range of thickness for the transparent resin layer, as required by the claim language, is an obvious matter of design choice.

17. As for **Claim 16**, while Isokawa discloses a solid state image-pickup device comprising a micro lens matrix (see figure 3) including a plurality of lenses (7) formed adjacent to one another on an undercoat layer (2) wherein between adjacent lenses (7) a ditch (6) is formed in the undercoat layer (2); Isokawa does not disclose wherein a transparent layer covers the solid-state image-pickup device including covering said plural resin lenses with substantially the same thickness and the ditch between said adjacent resin lenses.

On the other hand, Nakai et al. also provides a solid state image-pickup device including a micro lens matrix formed by a plurality of micro lenses. More specifically, Nakai et al. disclose, as shown in figure 1 and as stated in the abstract, a micro lens matrix comprised of a plurality of micro lenses (1). Furthermore, Nakai et al. teach, that a transparent resin layer (6; "epoxy resin, acrylic resin, polyester resin," etc.) covers the solid state image-pickup device including covering the plurality of micro lenses (1) with substantially the same thickness ("given thickness over a micro lens surface uniformly") and the gap between the adjacent micro lenses (clearly shown figure 1).

As stated in the abstract, at the time the invention made, one with ordinary skill in the art would have been motivated to include a transparent layer that covers the plurality of micro lenses with substantially the same thickness and covering the gap between the adjacent micro lenses, as clearly taught by Nakai et al., in the solid state image-pickup device including micro lenses and a ditch between adjacent micro lenses, as disclosed by Isokawa, as a means to provide an antireflective coating so as to increase the light absorption efficiency of the solid state image-pickup device. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to provide a transparent layer that covers the plural resin lenses with substantially the same thickness and also covers the ditch between said adjacent resin lenses.

18. For **Claim 17**, Isokawa discloses, as shown in figure 3 and as stated in paragraphs 0014 – 0016, a solid image-pickup device, comprising:

a micro lens array (7; at least a single row array of lenses) formed by a plurality of resin micro lenses arranged in a matrix (Adjacent lenses 7 in figure 3 at least form a one row/column by two row/column array.);

an undercoat layer (2) to fix said micro lens array (7) and having a ditch (6) formed between adjacent said resin micro lenses (Figure 3 clearly shows a “ditch” formed in the flat layer 2 between adjacent lenses 7.).

While Isokawa discloses a solid state image-pickup device comprising a micro lens matrix (see figure 3) including a plurality of lenses (7) formed adjacent to one another on an undercoat layer (2) wherein between adjacent lenses (7) a ditch (6) is formed in the undercoat layer (2); Isokawa does not disclose wherein a transparent layer covers the solid-state image-pickup device including covering said plural resin lenses with substantially the same thickness and the ditch between said adjacent resin lenses.

On the other hand, Nakai et al. also provides a solid state image-pickup device including a micro lens matrix formed by a plurality of micro lenses. More specifically, Nakai et al. disclose, as shown in figure 1 and as stated in the abstract, a micro lens matrix comprised of a plurality of micro lenses (1). Furthermore, Nakai et al. teach, that a transparent resin layer (6; “epoxy resin, acrylic resin, polyester resin,” etc.) covers the solid state image-pickup device including covering the plurality of micro lenses (1) with substantially the same thickness (“given thickness over a micro lens surface uniformly”) and the gap between the adjacent micro lenses (clearly shown figure 1).

As stated in the abstract, at the time the invention made, one with ordinary skill in the art would have been motivated to include a transparent layer that covers the plurality of micro lenses with substantially the same thickness and covering the gap between the adjacent micro lenses, as clearly taught by Nakai et al., in the solid state image-pickup device including micro lenses and a ditch between adjacent micro lenses, as disclosed by Isokawa, as a means to provide an

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antireflective coating so as to increase the light absorption efficiency of the solid state image-pickup device. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to provide a transparent layer that covers the plural resin lenses with substantially the same thickness and also covers the ditch between said adjacent resin lenses.

*Allowable Subject Matter*

19. **Claims 7 – 11** contain allowable subject; however, cannot be allowed until the above objections are resolved.

The following is a statement of reasons for the indication of allowable subject matter: Isokawa in view of Nakai et al. (the closest prior art) teach in combination a solid image-pickup device, comprising: a micro lens array formed by a plurality of resin micro lenses arranged in a matrix, an undercoat layer to fix said micro lens array and having a ditch formed between adjacent said resin micro lenses; and a transparent resin layer covering said plural resin micro lenses with substantially the same thickness and the ditch between said adjacent resin micro lenses. However, the closest prior art does not teach or fairly suggest wherein the difference between the height of the surface of said transparent layer in the ditch in the diagonal direction of said lens array and the height of the tops of micro lenses each consisting of said resin lens and said transparent resin layer covering the surface of said resin lens is larger than the difference between the height of the surface of said transparent layer in the ditch in an arranging direction of said lens array and the height of the top of the micro lens.

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20. **Claim 2** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and alleviating all objection above.

The following is a statement of reasons for the indication of allowable subject matter: Isokawa in view of Nakai et al. (the closest prior art) teach in combination a solid image-pickup device, comprising: a micro lens array formed by a plurality of resin micro lenses arranged in a matrix, an undercoat layer to fix said micro lens array and having a ditch formed between adjacent said resin micro lenses; and a transparent resin layer covering said plural resin micro lenses with substantially the same thickness and the ditch between said adjacent resin micro lenses. However, the closest prior art does not teach or fairly suggest wherein the minimum thickness of said transparent resin layer in the ditch between said adjacent resin lenses in the diagonal direction of said lens array is smaller than the minimum thickness of said transparent resin layer in the ditch between adjacent resin lenses in the arranging direction of said lens array.

### ***Conclusion***

21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


22. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Justin P Misleh whose telephone number is 703.305.8090. The Examiner can normally be reached on Monday through Thursday from 7:30 AM to 5:30 PM and on alternating Fridays from 7:30 AM to 4:30 PM.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Wendy R Garber can be reached on 703.305.4929. The fax phone number for the organization where this application or proceeding is assigned is 703.872.9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JPM

December 20, 2004

  
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